VOL. XIV. NO. 2.—BOTANICAL GAZETTE.—FEB., 1889.

Undescribed plants from Guatemala. VI.

JOHN DONNELL SMITH.

(WITH PLATES VI and VII.)

GUATTERIA GRANDIFLORA.—Arboreous: leaves shortly petioled, coriaceous, glabrous except pilose midrib beneath, obovate-oblong (6–8 inches), a third as broad, cuspidate: peduncle terminal, 1½–2 inches long, articulated midway, lanceolate bract an inch long: petals thrice exceeding ovate sepals, oblong (14–16 lines), obtuse, nearly equal, fleshy, fuscous-velvety, the 3 interior glutinose-papillate toward base within: berries few (10–12), glabrous, ellipsoid, each end obtuse, 10 lines long, half as broad, 4-times exceeding incrassate stipe; seed corrugate.—Pansamalá forest, Depart. Alta Verapaz, alt. 3,800 feet, May, 1887 (Ex Pl. Guat. Tuerckh., qu. edid. J. D. S., 1,235).—The few other species with shortly stipitate carpels, of which *G. Quinduensis* Tr. et Planch., seems the most nearly related, differ respectively, as described, by axillary inflorescence, or smaller flowers, or less elongate fruit.

CLIDEMIA CYMIFERA (§ *Sagræa* Cogn.).—Branchlets, petioles, leaf-veins and calyxes stellate-furfuraceous, rubescent: leaves a little or twice exceeding petioles, ovate-acuminate, 3–5 inches long, somewhat unequal in the pairs, 5–7-nerved from cordate base, glabrate above, margins scabrociliate: cymes from axillary bracteolate nodes pseudo-fascicled, at length 1–3 and pedunculate, trichotomous, 1½–2 inches long; axes divaricate, filiform, exceeding flowers, glabrous, red: calyx urceolate, teeth shortly subulate-appendaged: petals obovate-oblong (4–5 lines), twice exceeding calyx, roseate: anthers incurved, shorter than filaments, inappendiculate connective not produced: ovary one-third free, conical apex glaucous: berry oval.—Rocks of a waterfall, Pansamalá, alt. 3,800 feet, June, 1885 (Ex Pl. cit. 709).

BLAKEA GUATEMALENSIS (§ *Eublakea* Triand).—Fur-

furaceous, anisophyllous: leaves glabrate, chartaceous, 5-nerved; the larger oval, caudate-acuminate, minutely cordate, 5 or 6 inches long, half as broad; the smaller ovate-lanceolate, 10–15 lines long: peduncles geminate or solitary, 1½–2 inches long, sub-equalling internodes: bracts 1-nerved; the exterior ovate-lanceolate, shorter than flowers, twice exceeding the obovate interior: calyx-limb narrow, sinuate: petals obovate-spatulate, nearly an inch long, roseate: anthers laterally connate, oblong, connective slender for the genus, its acutely conical spur a line long: style arcuate, elongate (8 lines), stigma capitellate: berry ribbed, 6-celled.—Pansamalá, alt. 3,800 feet, Sept., 1886 (Ex Pl. cit. 778).—*B. gracilis* Hemsl., with nearly similar involucre, flower and fruit, is isophyllous, leaves acute at base, solitary peduncles several times exceeding internodes, bracts 3-nerved, anthers free and inappendiculate.

Explanation of Plate VI; Fig. 1. Flowering branch, nat. size. Fig. 2. Vertical section of flower. Fig. 3. Flower deprived of petals and stamens, enlarged. Fig. 4. Stamen, enlarged. Fig. 5. Diagram of flower.

CLIBADIUM ARBOREUM. — Tomentose: leaves scabrid above, hairy beneath, triplinerved, appressed-serrulate, ovate-acuminate, 5–7 inches long, base narrowed to nearly half as long as petiole: corymb large, flat, dense: heads subsessile, bracts ovate-oblong: involucre 3 lines high; bracts 9–10, pubescent, ciliate, firm, strongly nerved, obtuse, disk epaleaceous: fertile flowers 5, uniseriate; achenia large (1½ lines long), thick, winged below apex, black, shining: sterile flowers 10–11; corolla exsert, 1½ lines long, lobes puberulous; abortive achenia equalling the perfect, like them naked except glandular-pubescent apex.—Pansamalá, alt. 3,800 feet, June, 1886 (Ex Pl. cit. 929).—Remarkable by arboreous habit, as stated by Mr. von Türckheim. Other Central-American species, all suffruticose, the first nearly allied, may be distinguished as follows:

C. Surinamense L., var. *asperum* Baker. Petioles short, leaves rounded at base: heads smaller; involucral bracts 6-8, acute; palets 2-3, linear: achenia small, short-obovate, dull-pale, upper half villose: corolla-lobes of sterile flowers conspicuously villose; abortive achenia hidden by shaggy hairs.

C. leiocarpum Steetz. Petioles very short, leaves narrowly ovate-lanceolate: heads small; involucral bracts glabrous, long-ciliate, bi-form, acutish: achenia broad, thick, black, apex naked and tuberculate.

C. acuminatum Benth. Petioles long: fertile flowers bi-seriate; sterile fewer (3-4), subsessile by short abortive achenia.

C. erosum DC. Petioles long, leaves unequally incised-serrate: heads distinctly pedicellate: fertile flowers bi-seriate, sterile 10–12.

NEUROLÆNA LOBATA R. Br., var. INDIVISA.—Glabrate: leaves membranaceous, scabrid above, broadly lanceolate, tapering finely to each end, lobeless: heads large.—Pansamalá forest, alt. 3,800 feet, April, 1887 (Ex Pl. cit. 1,223).—Approaching *N. macrocephala* Schz. Bip. in foliage and size of heads, but involucres remain distinct.

ARDISIA MICRANTHA.—Arboreous: leaves from short internodes, glabrate, coriaceous, obovate-elliptical, 4–6 inches long, acuminate, narrowed to short margined petiole: panicle terminal, subsessile, exceeded by leaf; branches complanate, margined, alternate, sub-simple, closely racemose-flowered toward apex; pedicels exceeding ovate alabastra, bractlets small: calyx-divisions ovate, ocellate, glandular ciliate: corolla twice longer (2½ lines), lepidote without and toward base within, sub-partite, segments oblong-ovate: stamens exceeding corolla, at length long-exsert, cordate anthers ¼ line long: style shorter than corolla, ovary rubro-punctate.—Coban, Depart. Alta Verapaz, alt. 4,600 feet, March, 1888 (Ex Pl. cit. 1,365).—*A. compressa* HBK., and *A. revoluta* HBK., with somewhat similar foliage and panicles, are distinct by anthers equaling or exceeding filaments; *A. bracteosa* A. DC., with nearly similar stamens, has sessile flowers exceeded by their bracts, tubular calyx and corolla acutely cleft.

TOURNEFORTIA BICOLOR Swz., var. CALYCOSA.—Calyx-segments glabrate, linear, two-thirds as long as corolla.—Pansamalá, alt. 3,800 feet, July, 1886 (Ex Pl. cit. 980).

IPOMŒA DISCOIDESPERMA (§ *Strophipomœa* Chois.)—Leaves twice exceeding petiole, entire, ovate, caudate-acuminate, base truncate, 3½–4½ inches long: peduncle exceeding petiole; pedicels 2–3, shorter than calyx, tetragonal-incrassate above, bracts minute: sepals elliptical, an inch long, smaller within: corolla yellow, infundibular, 2 inches long, tube short: stamens equal, one-fourth as long as corolla: filaments dilated at base, more than twice exceeding oblong anthers: style shorter, stigma 2-globose: disk large, pulvinate: ovary 2-locular, 4-ovulate, ovules arachnoid: capsule coriaceous, globose, over an inch in diameter, 1-locular,

4-valved: seed 1, oblate, an inch broad, half as high, black, velvety.—Pansamalá, alt. 3,800 feet, June, 1885 (Ex Pl. cit. 744). Collected also by Dr. Sereno Watson (412 Fl. Guatemala. Yzabal, Apr. 1885). The tardily dehiscing capsule exhibits scars of three obsolete ovules; vestiges of the dissepiment appear in the form of a narrow ring encircling the seed, free from both it and the septa, and attached only at the conspicuous hilum.

The eccentric seeds justify the conjecture that this is the plant known only by its capsules in Kew herb., which is referred to as follows by Seeman (Bot. Voy. Herald), and which has not been cited by later authors: "683. Ipomœa sp. Nomen vernacul. *Botón de terciopelo.* Veraguas. The capsule of this species is quite glabrous, but the seeds are densely covered with short, stiff, black hairs, giving them the appearance of black velvet buttons."

SOLANUM SIDEROXYLOIDES SCHLECHT., var. OCELLATUM.—Leaves elliptical, acuminate, base rounded, nearly smooth above, pubescent beneath, veins tomentose: calyx-teeth replaced by conspicuous black globose intramarginal glands.—Pansamalá, alt. 3,800 feet, May, 1887 (Ex. Pl. cit. 1,155). Schiede's original of Schlechtendal's description has been compared in the Berlin Herb. by Prof. Urban with the above, and fragments communicated by him. It differs only by more manifestly ovate and acuminate leaves floccose beneath, and minutely-toothed calyx. To the typical form seem referable 827 Botteri, 2,837 Bourgeau, 923 Türckheim; also the following unnamed specimens at Kew (not cited in *Biologia Centrali-Americana*), which have been compared by Dr. N. L. Britton: 1,157, 1,172 Galeotti: 233 Linden: 855, 856, 857, 897 Botteri.

SOLANUM OLIVÆFORME.—Herbaceous, glabrate, repent, 2–3 feet long: petioles margined, amplexicaul, 1–2 inches long; leaves minutely lepidote above, pale-glaucous beneath, trisect, cordate; leaflets obtuse at each end, contracted to margined petiolules; the terminal rhomboid 12–18 lines long; the lateral half as large, sub-opposite, oval, inæquilateral, base truncate on upper side and produced on lower: peduncles extra-axillary, sub-equalling petioles, exceeding 3–5-flowered scorpioid cyme: calyx-teeth triangular: corolla-segments linear-oblong (3 lines): anthers oblong, dehiscence longitudinal: berry ellipsoid, over an inch

long, nearly half as broad.—Mountain-precipice in Pansamalá, alt. 3,800 feet, May, 1887 (Ex. Pl. cit. 1,226).—The Bolivian *S. tripartitum* DC., which seems to be the most nearly related species, has, among other differences, pisiform fruit.

TETRANEMA EVOLUTA.—Leaves membranaceous, reticulate veins beneath and erose margins pubescent: peduncles ex-alate, shorter than leaves, sub-equalling paniculiform scorpioid cymes, elongate axes 2–4-nate: calyx-segments attenuate, 3–4 lines long: corolla nearly an inch long, white with purple spots: capsule ellipsoid.—On rocks, Pansamalá, alt. 3,800 feet, May, 1887 (Ex. Pl. cit., 1,218).—The generic character drawn strictly from the sub-capitate umbelliform inflorescence of the monotype, *T. Mexicana* Benth., needs enlargement to include this second species. The former differs also by glabrous fleshy crenulate leaves exceeded by margined peduncles, shorter calyx, smaller corolla, globose-ovoid capsule.

LOUTERIDIUM DONNELL-SMITHII, Watson, Proc. Am. Ac. xxiii, 284.—The author of this recent genus makes the following correction in one of its characters: "The upper sepals were described as distinct, and the three lower as united. The reverse is the fact. The third broad and apparently simple sepal is posterior, while the two lower, which remain distinct, are lateral, one upon each side of the sac of the corolla." In examining Dr. Watson's own undetermined collections in Guatemala this plant has been found to occur as "No. 292, Banks of Chocon river, Depart. Yzabal, March 1885."

Explanation of Plate VII: Fig. 1. Cyme and leaf. Fig. 2. Flower with calyx removed and corolla laid open. Fig. 3. Vertical section of ovary. Fig. 4. Ovule. Fig. 5. Capsule divided transversely. Fig. 6. Dehiscent capsule. Fig. 7. One valve showing placenta and retinacula. Fig. 8. Seed divided transversely. Fig. 9. Embryo. Fig. 10. Diagram of flower. (Figs. 1, 2, 5, 6 and 7 are natural size: the others are variously magnified.)

SCUTELLARIA ORICHALCEA.—Suffruticose, a foot high, pubescent: leaves minutely scabrid above, pulveraceous beneath, oblong-lanceolate, obtuse, coarsely toothed, 16–21 lines long, 2–3 times exceeding petiole: raceme terminal,

secund, equalling leaves; flowers 12–15, pubescent, alternate and opposite, twice exceeding foliaceous bracts: calyx 2 lines long, equalling pedicel: corolla yellow, 10 lines long, tubular nearly to lips and half a line wide; posterior lip 1 line long, united with equal lateral lobes, nearly twice exceeding patent anterior lip: filaments scarcely margined; anthers ciliate.—Rock-crevices, Chajrax, Depart. Alta Verapaz, alt. 2,000 feet, Dec., 1887 (Ex Pl. cit. 406).—Affinity is with the recently described *S. lutea*, Botan. Gaz. xiii. 76; but conspicuously different by filiform corolla.

DAPHNOPSIS RADIATA (§ *Nordmannia* Benth. et Hook.).—Fruticose, younger parts and inflorescence sericeous-pubescent: leaves coriaceous, smooth and shining above, paler and veiny beneath, oblanceolate, 8 or 9 inches long, 2 inches broad, each end acutely attenuate, sessile: peduncles extra-axillary, 1½–2 inches long, terminated by a globose 35–38-flowered umbel 16 lines in diameter; pedicels filiform, twice exceeding flowers: pistillate perianth urceolate-fusiform, roundish unequal lobes ½ line long: staminodes most minute: style equalling sub-stipitate ovary, large globose stigma included by connivent perianth-lobes: staminate flowers not seen.—Mountain-forest, Coban, alt. 4,600 feet, Feb., 1888 (Ex Pl. cit. 1,163).—Well marked by large leaves, numerous elongated pedicels, small perianth-lobes, long style.

HYPOXIS RACEMOSA (§ *Euhypoxis* Baker).—Tuber oblong, ¾ inch thick, neck elongate: leaves plicate, carinate, 7–9-veined, a foot or more long, 6 lines broad: scapes 5–6, suberect, a third shorter than leaves: racemes densely villose, 2–3 inches long, 7–8-flowered; pedicels equalling bracts and internodes, alternate above: exterior perianth-segments green on face with colored margin, linear-lanceolate, 5 lines long, 1 line broad; the interior a little smaller, more than twice exceeding stamens: style with stigma equalling filament: ovary trigonal, equalling limb.—Coban, alt. 4,300 feet, May, 1886 (Ex Pl. cit. 33).—A more robust plant than any forms of *H. decumbens* L., and distinct from the var. *major* Seub., by rhizome, distinctly racemose inflorescence, long-pedicellate flowers, elongate perianth. Collected also in Mexico by Botteri (80, 455, 463).

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On Cuscuta Gronovii.

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(WITH PLATE VIII.)

For a parasite that is parasitic from its heart and with all its heart, after having tried an honest life, there is perhaps no better example than dodder, which in our region (S. Hadley, Mass.) is Cuscuta Grenovii. We find it in abundance in autumn, early and late, twining its orange-colored stems about grass, solidago, alder, and the like, with a glory of white, bell-shaped flowers, in cymose clusters, appearing as lateral buds in the axils of bracts.

In preparing for the study of Cuscuta, fresh plants were placed in alcohol, some were dried—as gathered on the host—and seeds were sowed in pots. From the first, imbedded in celloidin, slides were prepared. The dried specimens yielded knowledge of external parts and abundance of seeds, which were valuable in ways that will appear later. The seeds are exalbuminous, of comparatively large size, with a conspicuous hilum and hard testa; but the latter yielded readily to soaking in dilute potash, and careful dissecting removed the two coats and freed the coiled, snake-like embryo (fig. 1). The root end of the embryo lies outermost, and is slightly enlarged, more noticeably so after germination, when it evidently remains, for some time, a store-house of nourishment.

The time required for germination was found to vary much. Some of the autumn-gathered seeds germinated in three days, after a few days' soaking; others, obtained from alder twigs out of doors, in February, and sowed dry, were three weeks in showing signs of life. The end of the stem which first emerged from the seed-coats was very soon covered with numerous short rhizoids, and careful observations failed to discover any trace of a root-cap. Figs. 2 and 3 illustrate seedling dodders. The tip produces, even at a very early stage, the rhizoids mentioned. Comparing fig. 3 with fig. 1, it will be seen that the root-hairs must have grown very rapidly, none being on the embryo, just before germination. Fig. 2 is the root end of a seedling 2 inches long, and hence the rhizoids are much further developed. Fig. 5 illustrates one of the most interesting things in my study of the plant, and one that I could not find mentioned by any

observer, viz., a method by which the plant cut itself off from normal nutrition. Having reached some suitable host—a twig of Forsythia viradissima in this case—it twines around it like a tendril, by two or three coils, and in coiling contracts so as to draw itself nearer the host. This contraction, if the seedling is not too deeply rooted, or too slack between the soil and the support, pulls the roots from the earth and leaves the plant—a parasite by suicide—with roots at varying distances above the soil, $\frac{1}{4}$ of an inch being perhaps the highest I observed. If the plant is not uprooted in this manner or by the lengthening of the internode of the host to which it is attached, as sometimes happens, the lower part of the stem dies, and the connection is thus severed with the absorbing root, not, however, until the enlarged portion of the stem has been drained of its nourishment or the plant has reached some other supply. All the plants that germinated earliest, of those we studied, hung themselves; the later ones—those washed deeper into the soil—died at base. Our gardener, noticing the hanging ones, said, "Those are not plants; they crawl up sticks like an inch-worm." These germinating plants are white below, but yellowish-green at summit, suggesting that the dodder, even in its degeneracy, has some chlorophyll and may elaborate food for a short time. The amount of nourishment stored in the embryo hardly seems sufficient to enable the seedling to produce such a length of stem before reaching a host, as is done by some. Other things, too, indicate ability to assimilate, such as the greenness of buds and branches for some time after they appear. This coloring matter is removed by alcohol.

To illustrate the rapidity of growth after germination, I give the statistics of a single plant, grown in my own room under a bell-jar, in circumstances perhaps not the most favorable, as there was much variation in temperature, especially at night. The seeds were collected out of doors on some alder twigs, and sowed immediately, February 29. The first plantlet appeared at the surface of the soil March 20, and twenty-four hours later, at 8 A. M., March 21, was one inch long, with tip doubled back and coiled once about itself like a whip upon its stalk. All was white but the coiled tip. At 10 A. M. it had more nearly uncoiled and had gained one-fourth inch in length in the two hours; at twelve it was erect and slightly elongated; at 6 P. M. its length was one and one-half inches and its inclination toward the nearest host. Measurement at 8 A. M., March 22, showed it to have

gained three-fourths of an inch in twenty-four hours—one-third of that length between 8 and 10 A. M. Careful observation between the corresponding hours the second day showed the same gain, suggesting, what experiments with other seedlings seemed to corroborate, that 8 to 10 A. M. represented the maximum period of growth. The plantlet was then, at the height of two inches, touching its host. Contact caused it to coil like a tendril, although it was several times disturbed and shaken from its support, so that at 8 A. M., Saturday, the 24th, three days after germination, it was fast to its host with two close coils about the stem. Growth in length now ceased for several days, all its energy being expended in producing suckers and thrusting the haustoria into the host. March 26 the suckers were well developed, the root portion was brown and useless, the reservoir above the rhizoid portion exhausted of supplies and the plant apparently in position for an easy life. During this time the nutation of the tip of the seedling was opposite to the course of the sun.

From observation upon this and other plants it was evident that there is a limit to the size of stem they are able to encircle, and that the diameter must be small. One that I noticed attempting to surround a large geranium stem was unequal to the task, and coiled back upon itself twice upon the side of the trunk. Plants showed very little discrimination in the selection of hosts, attacking everything that offered support—dead and dying stems, as well as fresh ones, and even the rim of the flower-pot. They usually recoiled after one turn about a dead twig, and extended the tip further unless the root had been lifted from the soil. When a suitable host was obtained, the tip nestled down close to it and did not attempt further wandering.

We failed, for a long time, in all our attempts to cultivate the dodder—further than to obtain a few coils about the stem. We never suspected the unsuitable character of the hosts, as out-door dodders do not seem particular. But an enterprising seedling taught us the lesson by seizing a young geranium petiole, just emerging from the bud, and beginning to grow by feet in the same pot where a Eupatorium-entertained companion, of the same age, grew scaly, stubby and by inches, and all others died. After this there was no difficulty in raising dodders.

The suckers are, outwardly, enlarged fleshy disks, which the parasite forms and presses hard against the host, sending

into it from their center organs called haustoria by which they absorb the elaborated juices as roots take moisture from the soil. They differ from true roots, as does the root-acting end of the stem, in the absence of a root-cap.

An attempt to remove the dodder from a stem to which it is well attached often ends in taking with it at least the cortex of the plant on which it grows. Sections either longitudinal or vertical through the parasite, in position on its host, median as regards a sucker, will explain this. Each sucker starts, as does a root, in the vascular tissue of the stem, and is a cylinder, sharpened like a blunt pencil where it enters the host and enlarges immediately afterward. Thus is made a sort of neck about which the epidermis of both host and parasite fit very neatly; the sudden enlargement of the latter, in its new quarters, serving, as does a nut on a bolt, to prevent its easy removal.

The suckers, in their origin, are domes of meristem tissue before they reach the epidermis. Whatever lack of discernment the dodder may show in its selection of a host, once well placed, it lives up to its opportunities. It may, and usually does, in a woody stem like that of Solidago, send one root into the center, as if for deep anchorage, but spreads out by far the larger portion of its absorbing tissue in the cambium and sieve-tube regions where elaborated material is most abundant. Its tissue is easily distinguished from that of the host by its enlarged thin-walled cells with prominent nuclei. When the cutting was exactly median, the tissue seemed like a compact cylinder made up of filaments or cells, end to end, like meristem tissue, which branched, however, in a variety of ways inside the host. When growing on hollow stems like grasses, as it was common to find them, the haustorium scarcely branched, there being little opportunity.

One of the most singular phases of dodder life was a sort of self-grafting or self-parasitism. With a low power it was difficult to distinguish which was host and which guest, as the haustorium extended from the vascular region of one stem to the same of another. In examining the alcoholic specimens, I found this common, and it has often been repeated on those growing in my own room, usually under such circumstances as these: If a parasite had occasion to twine about an already thickly covered host, in its anxiety to obtain its share of elaborated material, it was willing to take a sort of second mortgage upon it, after it had passed into

the tissues of the first; this inter-parasitism also occurs frequently when for a long distance stems intertwine.

There is little differentia ion in the tissues of the dodder; it needs, very early, conducting tissue for carrying moisture through the stem to the rapidly growing and probably assimilating apex. To meet this need vascular tissue is found as soon as germination takes place. It is very simple, consisting of alternate stripes of tracheids and parenchyma, each about two rows of cells broad, and in the best developed stems occupies perhaps from one-third to one-half the diameter. It is well adapted for twining by this alternation with the softer parts, while the predominance of the latter favors the carrying of elaborated material, as it is in these such products travel. Iodine testifies to the presence of starch in the tissues of mature plants. Other reagents show, as do the markings on the walls, the woody nature of the alternate bands evident in a section of stem.

Of the adventitious buds, known to be abundant in the dodders, I have studied only those producing branches.

Their origin was in this manner: When a parasitic root had become well established, so that the plant was thoroughly engrafted upon the host, in an axil thus formed, a branch would arise, after the manner of an axillary branch on a normal plant. The regular branching of a stem of Cuscuta is unusual in the centrifugally arranged accessory buds (figs. 6 and 7), the last formed bud being farthest from the parent stem, though sections show it to originate in the axil bundle.

The epidermis of dodder varies with its position. On the long internodes between adjacent scales, stomata are rare, while over suckers, *i. e.*, on the side of the stem opposite them, very small stomata are quite abundant. This explains, in a measure, the continuance of life and growth for two weeks or more in branches cut from the parent stem and suspended in the air, though such stems never form coils or suckers.

Each flower has a short pedicel like the main stem in structure, a thickened receptacle, a five-lobed calyx and corolla with beautifully branched fringes lining the latter, and adherent stamens alternating with its lobes; the ovary has two cells with two ovules in a cell, and there are two knob-like stigmas on short styles. As to the manner of fertilization of the dodder, whether self or cross fertilized, I have had no opportunity to observe.

The two-celled ovary is composed of two carpellary leaves, with two cushion-like basal placentæ, each bearing two ovules, though at maturity there is often but one. The sections of placentæ are deceptive when the ovules are absent, having much the appearance of young ovules. The study of the ovules with reference to the layers in the seed coat gives evidence that in the mature testa there are three. The outer is quite unlike the two below, which are, perhaps, divisions of the same cell layer. They probably arise and cover the nucellus in an early stage, but are not differentiated into the mature form until a late period in the maturity of the ovule.

A short distance below the apex of each mature embryo, and always on the inside of the curve, as it lies coiled in the seed, is a well-developed scale (figs. 8 and 9. *a*). Another scale almost as well developed is usually to be found slightly below the apex of the embryo, but on the outer side of the curve (figs. 8 and 9, *b*). These two are separated by quite a portion of the stem in length, and in some cases the second scale is only partially differentiated, and yet a part of the tip, whose tissues, under a high power, are evidently of scales in process of formation. In no case were the scales opposite, or approximating it, as a pair of cotyledons would stand. What may be their relation to the embryo, I do not know, but the apex with its forming scales, of which this second one is sometimes a part, could well be a plumule. Comparing seedlings two inches in height with the embryos, the scales were evident (at least always the inner one), and at a distance from the growing tip corresponding to the increased length of the plant. They in every case soon turned brown.

How the dodder became a parasite is an interesting theme, and pleasantly treated in an article in the *Popular Science Monthly*, Vol. XXV. A weak stem, desire to reach the light, twining to accomplish this, and tasting juices by chance, they were nourished by them and given a tendency which increased in favorably situated descendants until, as Drummond states: "Henceforth to the botanist the adult dodder presents the degraded spectacle of a plant without a root, without a twig, without a leaf, and having a stem so useless as to be inadequate to bear its own weight." So it stands a monument of degeneration. Other plants with smaller beginnings have gone on to higher forms, while the dodder, as Prof. Drummond again, in substance, says, from

a breach of the laws of evolution, pays one of Nature's heaviest fines—loses the organs it once had.

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EXPLANATION OF PLATE VIII.—Fig. 1, mature embryo, dissected from seed. Fig. 2, tip of root of *a*, fig. 5. Fig. 3, enlarged view of 4, an embryo one half nat. size, just escaped from seed coats. Fig. 5, seedlings, one half nat. size. Figs. 6 and 7, accessory branching. Figs. 8 and 9, tips of embryos, enlarged; *a*, inner, lower scale; *b*, outer scale.

Development of cork-wings on certain trees. V.

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Passing now from stems of this type to those of Liquidambar, it is readily seen that whatever may be the end results, the immediate causes producing the wing are not the same as in the former type. Its eccentric development is a marked peculiarity, which, so far as I have been able to discover, occurs in no other instance. The question at once arises, whether the causes which produce eccentricity of growth in the annual rings of wood are likely to extend to the tissues arising from the cork cambium. If this were proven to be the case it might help but little in solving the problem before us, as it is a well known fact that the best authorities do not agree as to the causes of eccentric growth in woody tissues.

The function of protection which is universally assigned to the periderm naturally requires greater flexibility of structure, varying degrees of thickness, greater or less permeability for water and gases according to varying outward conditions, and, finally, greater or less outlay of material, which, in some cases, is retained, in others, discarded by the plant after it has performed its function. In this way it is easy to account for the variableness in periderm formation as illustrated in the genus Euonymus. This is more striking when contrasted with the uniformity prevailing in the structure of woody tissue. For example, when examining a large number of woods in regard to the presence or absence of bordered pores in the libriform, it was found quite unnecessary to carry the study farther than the genus. If a single species contained libriform with bordered pores, this was sufficient for the genus.

Several theories respecting eccentric growth fail at once when applied as a reason for the one-sided development of the Liquidambar wing. For example, that of gravity, which tends to produce a greater deposition of food material on the under side of horizontal branches. The wings never start from the under, but always from the upper, side of such branches. Another theory is that unequal pressure of the rind causes the inequality of growth of the ring, which is equally inapplicable in the present case. The agency of light seems a plausible theory in respect to the wings on the horizontal branches, but fails to explain their appearing first on one side of the young main axis.

On the other hand, if it be regarded from the standpoint of utility, as a contrivance to further the welfare of the plant, the question is again extremely puzzling. The probability of its serving to facilitate the interchange of gases, or affect transpiration in any way, seems much less likely than in the preceding instances. To those advocating the theory of water absorption, by various contrivances on leaves and stem, the trough-shape which the wings assume suggests the possibility of their use as water reservoirs and conductors to those parts of the stem where the water may be taken into the interior. This view is mentioned rather as a fanciful suggestion than otherwise, though both morphology and anatomy go to show the possibility of the tree making this use of the wing. It is just possible the suggestion is not more unreasonable than some similar ones made in reference to various appliances for making use of water.

There is, however, another view which suggests itself, and that is, the wing may be regarded as a contrivance for local increase of circumference without affecting the working quality of the remaining part of the periderm. By referring to fig. 18 it will be seen that on a four year's stem the circumference has been increased nearly one-half by the growth of the divided wing, the rest of the circumference remaining in the same condition as in the first season. Other branches are often nearly covered with the wing development, leaving only a narrow strip of circumference in its early condition. With increasing age comes increasing demand for protection, especially in case of the main axis. This is supplied by the corky growth extending itself to the whole circumference, while the interchange of gases is rendered possible by the breaking of tissues down to the new tender-walled cells near the phellogen layer. This tree is one of those described by

Moeller as having an internal periderm, or what is the same, producing a bark. What the connection is, or whether the knowledge of the exact structure of the internal would throw any light on the function of the superficial periderm I am not able to say.

In Euonymus alatus we have not the puzzling feature of eccentric growth, but the question of utility and the reason for such an outlay of material arises with still greater force. Here the last suggestion in reference to the wing of Liquidambar may be applied. In all the species of this genus it is an evident fact that the stem performs, in part, the office of assimilation. This is especially marked in the case of E. alatus, the chlorophyll-holding cells even having the form and arrangement of the regular palisade cells of leaves, while the number and size of leaves indicate the need of the aid of the stem in performing this labor. Now in stems even with the most exaggerated wings, both as to width and depth, it is still very evident that the entire surface, which acted as assimilating tissue before the beginning of the wings, still retains its original character and sustains the same relation to the outside air as before, during at least the first two years' growth of stem. By referring to the figures the comparatively immense gain in surface by the wing development is seen, while the surface, with the original palisade cells, remains intact and in working order. Now, were the material in these wings evenly distributed around the stem early enough to allow its growth in diameter, all assimilation of the stem would be effectually checked. By the present arrangement, the protection of a partial superficial periderm is given to the stem, assimilation is not checked, exchange of gases goes on by means of the stomata and whatever there may be taking place through the young tissue of the wing lying in lines along near the surface. It will be remembered that these walls are never suberized. The anatomy of E. Europæus and its varieties indicates a similar function. Surface growth is increased here with less outlay of material than in E. alatus, the wings never acquiring such size in the direction perpendicular to the surface.

The development of cork tissue from its beginning, was studied only in the two forms given, E. alatus and E. Europæus, var. purpurea; in these the origin of the phellogen cells was not the same, those of the first occurring about the stomata, and of the second in the thick-walled collenchymatic cells of the corner. Therefore it is not safe to draw

conclusions concerning the other species where corky projections occur, but which assume other forms than wings. The so-called warty excrescences on the stem of E. verrucosus, examined after they were fully developed, showed no difference between these and the ordinary cork formation, and no traces of lenticels from which they are said to arise. One species, E. Americanus, usually shows very few traces of corky growth on its young twigs, and never, so far as I can learn, produces the wing form. Some young stems were found, however, with a distinct line of corky growth so small as almost to require the lens to render it visible. This line was neither along the corners, as in Europæus, nor exactly between them, as in alatus, but ran close along the side of each corner. This suggests very strongly the idea of transition stages. The great variety in the matter of periderm formation within this genus suggests a fertile field for farther examination.

It is quite possible that undue importance has been attached to the fact of the difference between the fall and summer growth of cells, and that the walls of the few layers of plate cells are always suberized, while those of the summer's growth for the most part show little traces of suberin. The regularity with which this occurs, and the complete encircling of the stem by one or more layers of suberized cells during the winter, seem almost conclusive evidence that this is to protect the stem during its period of winter rest, and indicates also the demand for a greater supply of air in summer than in winter. This regularity, together with the fact that in all cases studied, except the one previously mentioned, the number of the year's rings of cork agreed with that of the woody tissues suggested that the immediate cause producing these results might be the same. That is the immediate cause producing the shortened radial diameter and usually thickened wall of the libriform cells, and the absence of tracheæ in the fall growth of woody tissue, might also be the cause of the shortened radial diameter and usually thickened wall of the fall growth of cork. Up to this time we have used the terms fall and summer growths loosely, referring to the later and earlier growth of the season. Now unless it can be proven that the time of this change of growth actually corresponds in both cases, it is evident there is nothing in the above suggestion, however plausible it may appear. This was attempted only in the case of Liquidambar, as the two other types were not available for constant daily study.

Sections cut from different Liquidambar trees, at different dates along the course of the summer's growth, and extending late into the fall, proved that the narrowing of the wood cells occurred at the same time as that of the cork cells. The work was begun too late in the season for the examination of the beginning of growth in the spring-time. Exact correspondence in time is not necessary, however, in case of the beginning of spring growth. Even were it proven that the real cambium resumed its activity a few days earlier or later than the cork cambium, this is no argument against the above hypothesis of the same cause acting on both kinds of cambium after both have been active during the summer.

Perhaps a partial apology should be made for offering the suggestion, as it seems hardly possible that this change from summer to fall growth in cork formation, which has so often been given as one of the important characteristics of cork, should not have been used in the recent investigations about the question of annual rings of wood, unless this question of correspondence in time had been thoroughly tested and found to fail. In all the recent literature to which I have had access I have found but one allusion to this, that is in the article by Gerber, above referred to. He says: "The early and late cork is like summer and fall wood, but that the time of their formation is not the same." Then he explains that the time of the beginning of the formation of the spring wood does not correspond with that of the formation of spring cork, but says nothing whatever respecting the time of beginning of fall growth.

In connection with this, a brief summary of the views about the cause of the difference between the spring and fall wood may be excused here. Sach's theory, stated in the first edition of his text-book, was that the peculiarity of the fall wood was due to the increased pressure of the rind at that time. Later experiments have failed to support this view. Among the first objections to this theory was the frequent occurrence of double year's rings. An article by Prof. Kny[7] on this subject, written in 1880, contains a statement of previous authorities, together with his own investigations, showing conclusively that double year's rings occur. Russow,[8] in an article in 1881, speaks against the theory of

[7] L. Kny Verdoppelung des Jahresring. Verhandlung d. bot. Vereins der Provinz Brandenburg, 1880, p. 1.

[8] Russow. Entwickelung des Hoftüpfels der Membran der Holzzellen und des Jahres ringes bei den Abietineen. Sitzungsber. d. natur. Ges. Dorpat, 1881. Bd. 6. Heft. 1.

rind pressure in this way: First, if this be the explanation, then it must have its effect in the rind formation, that is, there would also be year's rings in the tissues growing from the opposite or phloem side of the cambium, which does not occur. Secondly, there must be a gradual going over to this shortened diameter, as the pressure increases gradually. This is not the case. Thirdly, the pressure of fissures made in the rind by the frost is supposed to account for the diminished pressure in the spring time, but this fails to account for the fact that in the hot zones year's rings have been known to form the same as in colder climates. Russow suggested that instead of pressure on the cells from without, it was caused by a diminished turgescence within the cells, that the decrease in the amount of nourishment was the cause of this lack of turgor. Krabbe[9] next proved that the rind pressure is only very little greater in the fall than in the spring, so little as to make it impossible to be the cause of the short diameter. Moreover, the rind being cut so as to lessen the pressure rather tended to favor the production of the fall wood. Next, Wieler experimented as to the relative turgescence of cells of spring and fall, and proved this to be about the same during the entire vegetative period, therefore he claims there must be some other cause for the manner of growth of fall wood. He holds, with Russow, that the spring wood is better nourished than that of the fall.

In a review in the Bot. Centralblatt Bd. 34, no. 2, 1888, Sanio gives a brief summary of the conflicting opinions of Wieler and Krabbe. The latter states, we have now two theories as to the cause of the fall growth of wood, viz.: Wieler's and Hartig's. Both claim it to be the varying conditions of nutrition in the fall and summer; but the one, Hartig, says the tree is better nourished in the fall than in the spring; the other holds the contrary opinion. Hartig claims that the increased nourishment of the fall is used in adding to the thickness of the wall; Wieler explains the shortened radial diameter as due to the decrease in nourishment offered in the fall, and that the thickness of these walls depends on nourishment already acquired by the tree, and that their growth in thickness is quite independent of their growth in surface. He also claims that the greater or less number of ducts is a thing "per se," that it is not a constant factor in the problem, and does not attempt an explanation of this

[9] Krabbe. Ueber das Wachsthum des Verdickungesringes und der jungen Holzzellen in seiner Abhängigkeit von Druckwirkung. Abhandl. d. Akad, d. Wiss. zu Berlin, 1884.

feature. Krabbe criticises these views, and insists that an attempted explanation of the cause of fall wood should include all the characteristics. The reviewer favors the opinion of Wieler.

These few statements contain, perhaps, the principal results hitherto attained in this direction. If it could be proven that in the majority of instances the time of change from summer to fall growth of wood does not correspond exactly with that of the change in the cork tissue, the question would then arise as to the cause of the latter. It is certainly very significant that the only constant feature, viz.: shortened radial diameter of cells, is common to both, and furthermore, that the walls of the fall cork cells are often thicker than those of the summer growth, which is so frequently true of the fall cells of wood.

On the other hand, if it could be proven that the time of this change does correspond, there would be strong reason for supposing the cause to be the same. This would invalidate the theory of rind pressure, and add much in favor of the opinion that the question is solved whenever the cause of the shortening of the radial diameter is discovered.

Owing to the difficulty of access to the living specimens at proper times for experimenting but little could be done in that direction. It is, therefore, scarcely proper to speak, in conclusion, of definite results. Various facts in regard to the anatomy of these growths have suggested certain inferences, some of which are of such a nature as to be easily proven or disproven. The most important of these are:

I. Young stems, which are entirely encircled by cork wings, were found to lack other means of communication with the outside air. The anatomy of the wing in these cases is such as to enable it to supply this deficiency and to act as lenticels.

II. The wings of the horizontal branches of Liquidambar, covering as they do only part of the circumference, perform in part the same function, at the same time they increase the surface sufficiently to allow the growth within, while the remaining part of the stem's surface retains the character and office of the early periderm.

III. In Euonymus, the symmetry of the stem is preserved, the surface is enlarged by the wing, while all the remaining surface of the stem plays the part of assimilation.

IV. The characteristics of fall cork are exactly those of fall wood, the tracheal element alone excepted. Could it be

proven that these changes were due to the same cause, another means of deciding the question as to the cause of the fall growth of wood, or year's rings, would be obtained.

In concluding, the author begs leave to express thanks for all assistance from friends, in the way of material kindly furnished from various sources; especially to Dr. C. S. Sargent and to Mr. Meehan, of Philadelphia.

Biological Dep't, Univ. of Penn.

ERRATUM.—Page 252, line 23d from top, should read, According to the *plate*, etc.

Notes on North American Mosses. I.

CHARLES R. BARNES.

About a year ago, Mr. F. H. Knowlton, of the National Museum, sent me a package of mosses collected in August, 1887, by William Palmer, mostly on the Mingan Islands, which lie between Anticosti and the southern shore of Labrador. As the publication of the bulletin concerning this collection is delayed, it is thought best to publish the list in the GAZETTE. It includes one new species.

1. *Sphagnum papillosum* Lindb. In wet woods mixed with No. 8. St. Johns, Newfoundland.

2. *Gymnostomum rupestre* Schleicher (1807). On limestone cliffs, Mingan. This is one of the forms of this polymorphous species approaching G. curvirostrum closely, but it seems hardly worth while to give it a name.

3. *Dicranum undulatum* Ehrhart. Sand beaches, among trees, Mingan. This is the D. undulatum of Lesquereux and James' Manual. *D. undulatum* Turner is *D. Bonjeani* De Not.

4. *Bryum inclinatum* Br. & Sch. On limestone cliffs, Mingan.

5. BRYUM KNOWLTONI. (§ *Cladodium.*)

Plants densely cespitose; tufts 1–2 cm. deep, interwoven with red-brown rhizoids, mottled. Stems copiously branched by innovations, reddish. Leaves closely imbricate in bud-like tufts at the top of the innovations, not twisted when dry, the youngest bright green, the older dirty yellow, 1.5–2.0 mm. long, 0.60–0.75 mm. wide, carinate concave, ovate- to ob-ovate-lanceolate, the lower shorter, the upper narrower, all

abruptly and shortly acuminate; costa shortly excurrent, or dissolving in or ceasing just below the apex; margin entire or rarely slightly denticulate here and there, slightly revolute or plane, border usually indistinct (when present of one or two rows of narrow cells not thickened); cells rectangular and hyaline below, rhomboidal and densely chlorophyllose above. Flowers polygamous. Seta paler above, flexuous and flattened when dry, not twisted, about 1 cm. long; capsule red-brown or paler, rugose, pendent, oblong-pyriform; operculum small, strongly convex, apiculate, long persistent, not polished; annulus triple, revoluble; teeth of the peristome linear-lanceolate, strongly barred within, .050–.060 mm. wide, .320 mm. long, smooth above, segments of the endostome free, strongly nodose, split between along the keel, cilia two, rudimentary. Spores smooth, .024–.027 mm. diameter.

Crevices in rocks, Funk Island, Newfoundland.

This beautiful species, named for the gentleman who communicated the specimens, differs from its nearest allies in the following particulars:

From *B. pendulum* Schimp. in the longer collum and shorter pointed lid, the free nodose endostome, the short seta, the smaller spores, and the almost immarginate short-pointed imbricate leaves.

From *B. inclinatum* Br. & Sch. in the free nodose endostome, the persistent lid, the short seta, the almost immarginate leaves with less revolute edges and uncolored costa.

From *B. lacustre* Brid. in the long much-branched stems, appressed leaves, shorter seta, slender nearly naked vaginule and polygamous flowers.

Type specimens have been deposited in the herbaria of the National Museum, Harvard University and Columbia College.

6. *Polytrichum piliferum* Schreb. Under spruce, mixed with No. 8, Mingan.

7. *Polytrichum juniperinum* Willd. Mingan.

8. *Polytrichum juniperinum* Willd., var. *strictum* Wallm. (P. strictum Banks.) Mingan and St. Johns, Newfoundland.

Madison, Wis.

BRIEFER ARTICLES.

A few Cape Cod plants.—A two weeks' visit at Hyannisport, in the township of Barnstable, on the south shore of Cape Cod, Mass., in the latter half of August, 1888, revealed to me a most charming flora, a brief mention of which may be of interest. Though it is a ride of but three hours in the cars from Boston, yet the characteristic flowers are very different, as you are beginning to reach the northern limit of many plants.

The country is very flat, covered with a thick growth of Quercus silici folia, interspersed, here and there, with Pinus rigida, Quercus alba, and the like, while occasionally is to be seen a dense grove of Pitch Pine which has escaped the woodman's axe. Many acres of the township are devoted to the famous cranberry bogs, and it was a beautiful sight to see the well-kept patches, surrounded and cut by ditches, and so filled with the ripening berries that it was impossible to step upon the beds without crushing the fruit. One of the commonest wild flowers, at times whitening the fields and even growing by the wheel-tracks in the country roads, was the flat-topped Eupatorium hyssopifolium, which contrasted well with the gorgeous Hibiscus Moscheutos of the swamps, whose large rose-colored corolla was visible at a great distance. Not far from our house was the pond whence originated the pink variety of the Water Lily, Nymphæa odorata, and it was a strange sight to see the water dotted with the pink-red flowers. The pond is jealously protected from invaders.

The most attractive spots, however, for the botanist, were the many little ponds which are so abundant on the Cape. Most of these ponds have a clean, sandy border, and there we found, growing either near the water or in it, Coreopsis rosea, Sabbatia chloroides and stellaris and Lobelia Dortmanna, giving a most beautiful contrast of color to the margin of the pond, while less conspicuous plants were Fuirena squarrosa, var. pumila, Eleocharis olivacea, melanocarpa and Robbinsii, the latter's well-fruited spikes even narrower than the culm, Rhynchospora macrostachya, Scleria reticularis, and other commoner species of the Cyperaceæ. In places on the pond borders Lachnanthes tinctoria was very abundant, as also Xyris Caroliniana, flexuosa, and its var. pumila.

But the great charm of the ponds were the Utricularias. I never saw them in such profusion. In one spot Utricularia cornuta gave the bog a dash of yellow, while Utricularia purpurea was growing and flowering so abundantly that when the sun shone upon it, the surface of the pond was, as it were, painted purple. The pretty little Utricularia inflata was sailing at will on the water, and I found full-fruited plants in large numbers drifted against the shore. Beautiful specimens of Utricularia clandestina were common. This is a very modest plant to see, as its small yellow flower is alone visible above the slimy water which is its favorite home, but when carefully taken up, washed and mounted, it is a joy forever. The clandestine fruit is a prominent feature. At one pond we found what seems to be a very large form of Utricularia gibba. It certainly resembles nothing else, but will require more study. A ditch bordering a cranberry bog was fairly choked with Utricularia minor, but the most careful search revealed no trace of flower or fruit. Perhaps the most interesting find made by my friend (Mr. J. R. Churchill), just after my departure, was Utricularia subulata, var. cleistogama. I saw and determined fresh specimens of it afterwards. It was growing abundantly on the muddy border of a pond in all stages of development, from the early

budding state to the fruiting plant. By dissecting the buds, there was plainly revealed the minute, undeveloped, spurless, purplish corolla, with its two stamens enveloping the pistil. This is its most northern station reported thus far. I have collected the type on the Island of Nantucket.

Of the goldenrods, Solidago odora and ulmifolia were the common ones, during my visit, and the common Aster, in full bloom by September 1st, was the most interesting species Aster polyphyllus. I must not forget to mention the delicate Stachys hyssopifolius, abundant by ponds and along the roadside, and Lycopus sessilifolius, common by ponds, but not reported hitherto from this locality. Though mentioning but a few of the plants collected, I have tried to give some of the characteristic ones, and to show the attractiveness of the place from a botanical point of view. —WALTER DEANE, *Cambridge, Mass.*

EDITORIAL.

IT SEEMS to be the opinion of many that systematic work among phanerogams is an almost finished subject, and that in the great problems relating to histology, physiology, thallophytes, etc., lies the chief work of the future botany. Any one who has worked with phanerogams knows how far from true such a notion is, even when using the old gross characters. But it is still farther from the truth when one comes to consider the relations of histology and embryology to systematic work. These great and comparatively new departments of botany are furnishing data for the systematist, and until the intimate structure and life history of every plant is thoroughly known, the work of systematic botany can not pretend to be more than tentative. It is well known that the gross organs of phanerogams are subject to great variation, variations which are likely to arise in organs which have important work to do, and hence must attempt to adapt themselves to changing conditions. This fact frequently makes specific lines very confusing, and it is just here that histology comes to one's aid. The minuter structures are by no means so sensitive to external conditions as the gross organs, and are more apt to endure the strain of environment unchanged. It is, therefore, a tolerably safe rule that those organs are of greatest use to the systematist which are of least vital importance to the plant, and histology thus often gives us a specific thread upon which to string the widest diversity of gross organs. Contributions to systematic work among phanerogams can be made in no more effective way than by searching their minute structures for characters that will hold. Our ambitious young botanists would be more profitably engaged in doing such work than in magnifying the variations to be discovered in gross organs and insisting that they should be considered new varieties or species. This work of hunting for variations in flowers, leaves, etc., simply illustrates what every one already knows, that essential organs will vary.

NOTES AND NEWS.

CELAKOVSKY has lately described a hybrid between *Anthemis Cotula* L. and *Matricaria inodora* L.

DR. DOUGLAS H. CAMPBELL has published[1] his paper on the germination of the spores of Marsilia Ægyptiaca. The main facts have been already published by him in the *Bulletin* of the Torrey Botanical Club, 1888, p. 258, a paper read before the A. A. A. S.

DR. HENRY L. OSBORN has retired from the editorship of the *American Monthly Microscopical Journal*. The *Journal* will continue under the business management of Mr. Smiley, and will be edited in Washington. Mr. Romyn Hitchcock, the former editor, has lately arrived from Japan.

HANAUSEK has reinvestigated the epidermis of the seeds of Capsicum, and has found that the thin outer wall, which has usually been called a cuticle or cutinized membrane, is mostly cellulose, with a thin inner layer *lignified*, as the very thick inner and side walls are.—*Ber. der deut. bot. Gesells.*, vi. 329.

IT WILL BE remembered that Dr. Gray and J. Hammond Trumbull, in their "Review of DeCandolle's Origin of Cultivated Plants, with Adnotations upon Certain American Species," in the *American Journal of Science* for 1883, contended stoutly for the American origin of two of the three plants of whose nativity DeCandolle was entirely uncertain. These were the garden bean (Phaseolus vulgaris) and squash (Cucurbita moschata). Wittmack has now found prehistoric seeds of Phaseolus vulgaris from North American graves among the collections of the Hemenway expedition to Arizona. Prehistoric seeds of the bean, so far as known to Wittmack, have not before been found in this country. The discovery is of special interest, therefore, as establishing Gray and Trumbull's theories that this land is the home of so important a food. It is to be hoped that a similar confirmation may be given to the evidence regarding the home of the squash.

WE HAVE already commended the *Hepaticæ Americanæ*, issued by Dr. L. M. Underwood and O. F. Cook. Decades I and II of this series of *exsiccatæ*, consisting of representative types of the more common species of the eastern United States, were issued in November, 1887. Decades III and IV, which are now ready for distribution, contain in addition a number of California species, including two never before distributed. The authors announce that at least two decades will be issued annually, if the necessary materials can be obtained; and it is not expected that the number of species to be eventually distributed shall be limited by political boundaries.

Contributions of desirable species are requested, and for every species furnished in sufficient quantity for distribution, a decade of the *exsiccatæ* will be given or some other recompense made.

The price of each issue of two decades is $1.25; they may be obtained of L. M. Underwood, Syracuse, N. Y. Only three sets of Decades I and II now remain.

[1] Berichte d. deut. bot. Gesells. vi. 340-344, 1 plate.

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DIRIGÉE PAR

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PROFESSEUR DE BOTANIQUE A LA SORBONNE

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La *Revue générale de Botanique*, dont nous publions aujourd'hui le premier numéro, s'adresse à toutes les personnes qui s'intéressent à la Botanique.

On y trouvera soit des Mémoires développés, soit de simples Notes qui se rapportent à toutes les parties de cette science : Anatomie, Physiologie, Classification, Géographie botanique, Paléontologie, Chimie végétale, Applications scientifiques de la Botanique, etc. Ces divers travaux seront accompagnés de planches tirées à part et de figures intercalées dans le texte.

En outre, à côté de ces publications relatives aux recherches originales, la *Revue générale* rendra compte des progrès accomplis dans les différentes branches de la Botanique par les savants français et étrangers. Ces comptes rendus, où l'on insérera des figures reproduites d'après celles des auteurs, tiendront le lecteur au courant de tous les travaux publiés soit dans les différents recueils, soit isolément.

PAUL KLINCKSIECK.

Les revues des travaux publiés sur les diverses branches de la botanique paraîtront, en général, tous les ans et seront rédigées :

La *Physiologie*, par M. Gaston Bonnier ;

Les *Études sur les Bactéries et les Fermentations*, par M. Léon Boutroux ;

Les *Études sur les Champignons*, par M. J. Costantin ;

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La *Classification et la géographie botanique des plantes vasculaires étrangères à la France*, par M. A. Franchet ;

Les *Études sur les Muscinées*, par M. F. Hy ;

La *Classification et la géographie botanique des Lichens*, par M. Hue ;

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La *Classification et la géographie botanique des plantes vasculaires de la France*, par M. Georges Rouy ;

La *Paléontologie végétale*, par M. le Mis de Saporta ;

etc.

Il sera rendu compte dans ces *Revues* de tous les Ouvrages, Mémoires ou Notes dont *un* exemplaire aura été adressé à M. G. Bonnier.

2655-88. — Coulet, Imprimerie Ouest.